



## Consumption of Caffeinated Energy Drinks Among Youth and Young Adults in Canada

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### ABSTRACT

The growing market for caffeinated energy drinks (CEDs) has caused concern about excessive caffeine intake and potential adverse effects, particularly among young people. The current study examined patterns of CED consumption among youth and young adults in Canada, using data from a national online survey conducted in October 2014. Data from a non-probability sample of 2040 respondents aged 12–24 from a consumer panel was weighted to national proportions; measures of CED consumption were estimated, including prevalence, excessive daily consumption, and context for use (locations and reasons). Separate logistic regression models for two outcomes, past-week consumption and “ever” exceeding two energy drinks in a day (as per common guidance), were conducted to examine associations with demographic variables (sex, age, geographic region, race/ethnicity, and language). Overall, 73.6% of respondents reported “ever” consuming energy drinks; 15.6% had done so in the past week. Any consumption of energy drinks in the past week was more prevalent among males, Aboriginal respondents (vs. white only or mixed/other), and residents of British Columbia. Among “ever-consumers,” 16.0% reported ever consuming more than two energy drinks in a day. Exceeding two in a day was more prevalent among older respondents (young adults aged 18–24), aboriginal respondents (vs. white only), and British Columbia residents. While the majority of youth and young adults had consumed energy drinks, about half were “experimental” consumers (i.e., consumed ≤5 drinks in their lifetime). Approximately one in six consumers had exceeded the usual guidance for maximum daily consumption, potentially increasing their risk of experiencing adverse effects.

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### 1. Introduction

The energy drink market has grown rapidly in recent years (Canadian Packaging, 2012; Harris & Munsell, 2015), with global consumption nearly doubling between 2006 and 2012 (Meier, 2012) and annual Canadian sales of over \$110 million (Nielsen, 2014). Marketing of energy drinks is often youth-oriented (Harris & Munsell, 2015; Pomeranz et al., 2013), and young adults aged 18–34 are a major target demographic (Heckman et al., 2010). However, there is concern about the risks and potentially harmful effects of energy drink consumption

on consumers' health, especially young people, due to the often high content of caffeine, sugar, and other ingredients (such as taurine, guarana, vitamins, and herbal ingredients) (Harris & Munsell, 2015; Pomeranz et al., 2013; Reissig et al., 2009).

Adverse effects after consuming energy drinks have been reported to poison control centres and regulatory authorities, and commonly include cardiac (e.g., heart palpitations/tachycardia), neurological (e.g., tremors, agitation/restlessness), and/or gastrointestinal symptoms, which are serious in some cases (Ali et al., 2015; U.S. Food and Drug Administration (FDA), 2012; Gunja & Brown, 2012; Seifert et al., 2011). Some studies have found associations between energy drink use and other risk behaviours (such as alcohol and drug use, smoking, sexual risk-taking, and violence) among adolescents and young adults (Azagba et al., 2014; Larson et al., 2015; Miller, 2008a; Terry-McElrath et al., 2014); however, energy drink consumption may fit into a broader risk-taking behavioural pattern rather than causing these behaviours. Research also suggests that the risk of harm or negative side effects, including other risky behaviours, may be increased when CEDs are used

Abbreviations: CEDs, caffeinated energy drinks.

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with alcohol (Bigard, 2010; Brache & Stockwell, 2011; Marczynski & Fillmore, 2014).

A primary cause of concern and increased risk associated with CED consumption is excess caffeine consumption, which can lead to adverse effects such as sleep disturbances, anxiety, jitteriness, gastro-intestinal effects, tachycardia and other cardiac symptoms, and in rare cases, seizures and death (Bigard, 2010; Harris & Munsell, 2015; Reissig et al., 2009; Seifert et al., 2011). Health Canada recommends limiting caffeine intake to 400 mg of caffeine per day for healthy adults, and no more than 2.5 mg/kg body weight for adolescents 13 and older (Health Canada, 2013a). Energy drinks on the Canadian market typically contain between 80 and 180 mg of caffeine per single-serving container (depending on size); in these products, Health Canada allows a caffeine content of 200–400 ppm (mg/L) and a maximum of 180 mg per serving/container (Health Canada, 2013b). Both a quantitative caffeine declaration and the qualitative statement “high caffeine content” are required on these beverages, as well as several cautionary statements, including: “Do not consume more than (X) container(s)/serving(s) daily” or “Usage: (X) container(s)/serving(s) maximum daily.” (Health Canada, 2013b), where X is 1 or 2, depending on the product’s vitamin and mineral content. While there are reports of adverse effects from excess caffeine consumption (Seifert et al., 2011), the prevalence of exceeding guidance for daily maximum consumption of energy drinks among youth and young adults has not previously been reported in Canada, although European findings suggest that this behaviour is not uncommon (Zucconi et al., 2013).

Health Canada has determined that a number of outstanding information gaps need to be addressed in order to develop and finalize regulatory requirements for these products; for example, consumption patterns of CEDs in the dietary context as food, and the effectiveness of labelling for mitigating risks. Temporary Marketing Authorization was determined to be the most appropriate regulatory tool, allowing these products to be marketed temporarily under specific conditions, while such information is gathered and reviewed. Specific marketing conditions include limits on caffeine content, vitamins and minerals, clear display of caffeine content, cautionary labelling, and restrictions on advertising CEDs to children (Health Canada, 2013b). Evidence on CED consumption among young people may be useful for informing future regulations for these products.

To date, there is limited research evidence on energy drink consumption in Canada, given the relatively recent increase in the availability and popularity of these products. While there are some Canadian estimates of consumption prevalence among youth, little is known about consumption among young adults, or patterns of consumption (amount, context, reasons for use, etc.). Some school-based studies have provided regional estimates of energy drink consumption: in the Atlantic provinces, 12.7% (of grades 7, 9, 10 and 12) consumed more than once per month (Azagba et al., 2014); in Quebec, 8.1% (of secondary levels 1–5; age 12–17) consumed at least weekly (Pica et al., 2012); and in Ontario, 19.1% (of grades 7 to 12) consumed in the past week (Paglia-Boak et al., 2013) and 18.2% (of grades 9–12) reported ‘usual’ weekly consumption (Reid et al., 2015). Little is known about how and when these products are being consumed, and few studies have extended beyond one or two basic measures of consumption.

The primary objective of the current study was to examine consumption patterns of caffeinated energy drinks (CEDs) among youth and young adults in Canada, specifically the prevalence and recency of consumption, exceeding common guidance for maximum daily consumption (>2/day), and context for use (locations and reasons for use).

## 2. Methods

### 2.1. Protocol

Data were collected via self-completed web-based surveys that took place from October 3–22, 2014. Surveys took approximately 20 minutes to complete, and were conducted in English or French.

Respondents were recruited via email through Leger’s consumer panel for web surveys (see [http://www.leger360.com/admin/legerweb/PanelBook\\_Canada\\_EN\\_2016.pdf](http://www.leger360.com/admin/legerweb/PanelBook_Canada_EN_2016.pdf)), which consists of >400,000 active members, half of them sampled using probability-based methods (using the Canadian Census), along with other non-probability-based methods, including commercial surveys (Leger, 2014). Respondents aged 18–24 were recruited directly, while those aged 12–17 were recruited through their parents and parental consent was obtained prior to youth accessing the survey. All respondents were provided with information about the study and asked to provide consent before participating. Respondents received remuneration from Leger in accordance with their usual incentive structure, which includes both points-based and monetary rewards (which can be cashed out or donated), as well as chances to win monthly prizes; the monetary incentive for this study was \$2.

The study was reviewed by and received ethics clearance from the Office of Research Ethics at the University of Waterloo. A full description of the study methods can be found in the Technical Report (Reid & Hammond, 2014).

### 2.2. Measures of energy drink consumption

The following preamble was included prior to questions about energy drinks: “We would like to ask you some more questions about energy drinks. Popular brands include Red Bull, Monster, Rockstar, NOS, Amp, and Full Throttle, but there are others. DO NOT include sports drinks, such as Gatorade or Powerade.” Ever consumption was assessed by asking, “Have you ever tried an energy drink, even a few sips? Include energy drinks mixed with other drinks.” Those who had ever consumed energy drinks were asked additional questions about their consumption.

Recency of consumption was assessed by asking “When was the LAST TIME you had an energy drink? Include any energy drinks mixed with alcohol.” (in the last 24 hours; in the last 7 days; in the last 30 days; in the last 6 months; in the last 12 months; More than 12 months ago; don’t know; refuse to answer). Responses were categorized into a measure of whether CEDs had been consumed in the past week. Lifetime consumption was assessed by asking “How many energy drinks have you consumed in your life? 1 drink = 1 can, container or glass, including energy drinks mixed with alcohol. If you are not sure, please provide your best guess.” (none; 1 drink or less; 2–5 drinks; 6–10 drinks; 11–20 drinks; 21–50 drinks; 51–100 drinks; More than 100 drinks; don’t know; refuse to answer). Maximum daily consumption was assessed by asking “What is the largest number of energy drinks you have ever had IN ONE DAY? Include any energy drinks mixed with alcohol.” Open-ended numeric responses were categorized as 1, 2, 3, 4 or more, and a measure of whether more than 2 CEDs had ever been consumed in a day was also created (a conservative measure for exceeding the common guidance for consumption).

To assess locations of consumption, ever-consumers of energy drinks were asked “Have you EVER had an energy drink in the following places? Select all that apply.” with the list of locations noted in Table 3. Ever-consumers were also asked about their reasons for using energy drinks: “Have you used energy drinks for any of the following reasons? Select all that apply.” with the list of reasons noted in Table 3.

### 2.3. Analysis

A total of 2055 respondents completed the survey. Due to missing data on the variables used for weighting (age, sex, province), 7 respondents were deleted, as well as the 8 respondents from the territories. Thus, a total of 2040 were retained for analysis. Respondents were excluded from analyses on a case-wise basis for measures with missing data.

Weights were constructed based on population estimates from the 2011 National Household Survey (Statistics Canada, 2014). Sample

probabilities were created for 40 demographic groups (age group by sex by region) based on weighted NHS proportions, and applied to the data set. Weights ranged from 0.45 to 5.74, with about two-thirds of respondents weighted between 0.5 and 1.5. Unless otherwise specified, all estimates reported are weighted.

Separate logistic regression models were estimated for two main outcomes: any energy drink consumption in the past week among all respondents, and whether ever-consumers of energy drinks had ever consumed more than the recommended daily maximum. Covariates included sex, age group (12–14, 15–17, 18–19, 20–24), region (British Columbia, Prairies, Ontario, Quebec, Atlantic), race/ethnicity (white only, any aboriginal, mixed/other/not stated), and language (English, French).

### 3. Results

#### 3.1. Sample characteristics

Demographic characteristics of the 2040 respondents retained for analysis are presented in Table 1.

#### 3.2. Consumption of energy drinks

Overall, 73.6% of respondents reported ever having consumed energy drinks (57.0% 12- to 14-year-olds; 69.4% 15- to 17-year-olds; 77.9% of 18- and 19-year-olds; 83.4% of 20- to 24-year-olds). Further, 15.6% of all respondents had consumed one in the past week (21.8% of “ever-consumers”).

Among all “ever-consumers” in the study, the mean age that respondents had first tried an energy drink was 14.9 years (SD = 2.9, Median = 15); however, this was limited by respondents' own age and varied accordingly. Table 2 outlines energy drink consumption measures among ever-consumers (frequency and amount); all varied significantly by age group.

##### 3.2.1. Past-week consumption (among all respondents)

Overall, 15.6% of all respondents reported consuming energy drinks in the past week. In the logistic model ( $n = 2040$ ), past-week consumption was significantly associated with sex ( $p = 0.003$ ), region ( $p = 0.005$ ), and race/ethnicity ( $p = 0.01$ ). Males were more likely than females to have consumed energy drinks in the past week (17.8% vs. 13.2%; OR = 1.45, 95% CI 1.13–1.86), and aboriginal respondents (27.2%) had higher odds than white only (14.9%; OR = 2.07, 95% CI 1.25–3.43) or mixed or other race/ethnicity (15.2%; OR = 2.16, 95% CI 1.27–3.69). Residents of British Columbia (23.5%) had greater odds of consumption in the past week than Ontario (13.7%; OR = 1.94, 95% CI

1.37–2.76) and the Prairie provinces (14.7%; OR = 1.84, 95% CI 1.22–2.76), but were not significantly different from the Atlantic provinces (18.3%) or Quebec (14.3%). There were no significant overall differences by age group (12.9% 12- to 14-year-olds; 17.4% 15- to 17-year-olds; 13.0% of 18- and 19-year-olds; 16.8% of 20- to 24-year-olds;  $p = 0.12$ ) or language (16.1% English, 13.6% French;  $p = 0.35$ ).

##### 3.2.2. Ever exceeding two CEDs in a day (common guidance for maximum daily consumption)

Among ever-consumers, 16.0% reported ever consuming more than two energy drinks in a day, which is the daily maximum most commonly recommended. In the logistic model ( $n = 1398$ ), exceeding two energy drinks in a day was significantly associated with age group ( $p < 0.0001$ ), region ( $p = 0.004$ ), and race ( $p = 0.01$ ). Compared to the youngest consumers (aged 12–14) studied (7.2%), young adults aged 18–19 (11.6%, OR = 2.07, 95% CI 1.08–3.97) and 20–24 (22.3%, OR = 3.84, 95% CI 2.22–6.62) had higher odds of ever consuming more than two CEDs in a day, but those aged 15–17 (13.2%) did not differ significantly ( $p = 0.12$ ). Aboriginal respondents (25.9%) were more likely to have exceeded 2/day compared to white only (15.9%; OR = 1.82, 95% CI 1.04–3.20), but did not differ statistically from other/mixed (14.2%,  $p = 0.10$ ). Ever-consumers in British Columbia (24.5%) had higher odds of ever exceeding 2/day than those in the Prairies (14.9%; OR = 2.20, 95% CI 1.35–3.59), Ontario (14.2%; OR = 2.04, 95% CI 1.34–3.09), and Quebec (13.5%; OR = 2.51, 95% CI 1.30–4.86), but not different from the Atlantic region (20.2%;  $p = 0.20$ ). There were no significant overall differences by sex (17.5% males, 14.4% females;  $p = 0.06$ ) or language (16.5% English, 14.0% French;  $p = 0.84$ ).

##### 3.2.3. Context for consuming energy drinks: locations and reasons for use

Table 3 shows reasons for using energy drinks, among ever-consumers, and by age group. There was significant variation by age group for nearly all reasons, with the exception of taste, weight loss/maintenance, and other reasons for trying or consuming CEDs. Alertness, curiosity, taste and some alcohol-related reasons were most frequently cited. Table 3 also outlines where respondents reported ever consuming energy drinks. All outcomes varied significantly by age group, except for consumption of energy drinks “somewhere else”.

### 4. Discussion

The findings indicate that energy drinks are popular among youth and young adults, with nearly three-quarters of respondents (73.6%) reporting ever consuming CEDs, and 15.6% reporting consumption in the past week. These prevalence estimates are consistent with estimates

**Table 1**  
Demographic characteristics of the sample ( $n = 2040$ ), Canada, 2014, unweighted % (n).

Characteristic	Youth		Young adults		Total sample ( $n = 2040$ )
	Age 12–14 ( $n = 393$ )	Age 15–17 ( $n = 620$ )	Age 18–19 ( $n = 208$ )	Age 20–24 ( $n = 819$ )	
<b>Gender</b>					
Female	48.3 (190)	47.4 (294)	65.9 (137)	60.9 (499)	54.9% (1120)
Male	51.7 (203)	52.6 (326)	34.1 (71)	39.1 (320)	45.1% (920)
<b>Age (mean; SD)</b>	13.3 (SD = 0.7)	16.1 (SD = 0.8)	18.6 (SD = 0.5)	22.2 (SD = 1.4)	18.3 (SD = 3.7)
<b>Language of survey</b>					
English	57.5 (226)	63.9 (396)	59.1 (123)	71.3 (584)	65.1% (1329)
French	42.5 (167)	36.1 (224)	40.9 (85)	28.7 (235)	34.9% (711)
<b>Ethnicity</b>					
White only (non-Aboriginal)	79.4 (312)	78.6 (487)	65.4 (136)	70.0 (573)	73.9% (1508)
Any Aboriginal	3.3 (13)	4.2 (26)	4.3 (9)	3.3 (27)	3.7% (75)
Mixed/other/don't know/refused	17.3 (68)	17.3 (107)	30.3 (63)	26.7 (219)	22.4% (457)
<b>Region</b>					
British Columbia	9.7 (38)	11.1 (69)	9.6 (20)	11.7 (96)	10.9% (223)
Prairies (AB, SK, MB)	8.4 (33)	13.9 (86)	12.0 (25)	14.2 (116)	12.7% (260)
Ontario	32.8 (129)	32.4 (201)	22.1 (46)	31.0 (254)	30.8% (630)
Quebec	43.0 (169)	36.8 (228)	51.4 (107)	38.5 (315)	40.1% (819)
Atlantic (NB, NL, NS, PEI)	6.1 (24)	5.8 (36)	4.8 (10)	4.6 (38)	5.3% (108)

**Table 2**

Estimates of caffeinated energy drink consumption, among ever-consumers (n = 1496), Canada (2014), weighted %.

Outcome	Youth		Young adults		Total (n = 1496)
	Age 12–14 (n = 393)	Age 15–17 (n = 620)	Age 18–19 (n = 208)	Age 20–24 (n = 819)	
<b>Last consumed an energy drink*</b>					(n missing = 43)
In the last 24 h	14.3	12.9	4.6	9.3	10.2
In the last 7 days	9.1	12.9	12.5	11.5	11.6
In the last 30 days	21.2	14.6	24.4	14.8	17.4
In the last 6 months	24.6	19.6	17.9	20.3	20.5
In the last 12 months	10.2	11.4	11.8	10.3	10.8
>12 months ago	20.6	28.6	28.8	33.8	29.7
<b>Lifetime consumption*</b>					(n missing = 55)
1 drink or less	50.5	36.5	32.8	21.7	31.5
2–5 drinks	19.9	22.9	20.3	19.2	20.3
6–10 drinks	11.4	9.2	11.0	13.7	11.9
11–20 drinks	6.1	11.5	14.0	13.2	11.8
21–50 drinks	8.4	12.0	14.0	12.4	11.9
51–100 drinks	2.9	4.3	3.4	9.6	6.3
>100 drinks	0.9	3.7	4.4	10.2	6.3
<b>Maximum # consumed in one day*</b>					(n missing = 98)
1 or less	75.6	71.2	56.8	48.0	59.1
2	17.2	17.2	30.1	29.7	24.9
3	5.7	7.3	7.9	11.5	9.0
4 or more	1.6	4.3	5.3	10.7	6.9

\* p &lt; 0.001, significant difference by age group in chi square test.

of weekly consumption obtained from school-based studies in Canada (Paglia-Boak et al., 2013; Reid et al., 2015).

While the majority of young people surveyed had ever tried energy drinks, experimental use appeared to be high, particularly among younger adolescents: about half of “ever consumers” reported drinking 5 or fewer (ever) CEDs in their lifetime (70% among those age 12–14), and

approximately 40% had not consumed one in the last 6 months. Other studies have indicated that a considerable proportion of energy drink consumption is experimental rather than habitual; for example, among adolescents in a New Brunswick study, only about half of past-year energy drink consumers drank them more than once in that time (Gupta et al., 2013).

**Table 3**

Context for caffeinated energy drink consumption (locations and reasons for using), among ever-consumers (n = 1496), Canada (2014), weighted %.

Outcome	Youth		Young adults		Total (n = 1496)
	Age 12–14 (n = 393)	Age 15–17 (n = 620)	Age 18–19 (n = 208)	Age 20–24 (n = 819)	
<b>Location of consumption (ever)<sup>a</sup></b>					(n missing = 50)
At work <sup>***</sup>	2.4	7.2	24.7	42.7	25.2
At school <sup>***</sup>	35.0	42.0	51.0	54.4	47.9
While driving <sup>***</sup>	1.5	2.6	12.1	26.3	14.6
At home <sup>*</sup>	47.6	43.2	47.8	53.6	49.3
At someone else's house <sup>**</sup>	29.5	42.6	40.0	43.0	40.2
At a restaurant <sup>**</sup>	3.5	2.9	2.5	6.7	4.5
At a bar/pub/nightclub <sup>***</sup>	0.2	1.0	25.7	38.1	21.5
At the gym or while playing sports <sup>*</sup>	13.7	16.7	8.1	11.1	12.3
Somewhere else <sup>b</sup>	5.8	6.3	4.5	4.2	5.0
<b>Reasons for using energy drinks<sup>a</sup></b>					
<b>Alertness</b>					
To stay awake or help concentrate for studying/work <sup>***</sup>	9.8	19.9	32.2	45.9	31.9
To stay awake or alert for driving <sup>***</sup>	8.0	20.5	29.3	36.7	27.1
To feel awake in general (not for a specific activity) <sup>***</sup>	1.2	3.2	12.8	24.0	13.8
<b>Alcohol-related</b>					
For going out or partying <sup>***</sup>	0.7	4.1	21.7	36.8	21.1
To mix with alcohol <sup>***</sup>	3.0	8.0	15.0	26.6	16.6
To cope with a hangover <sup>***</sup>	0.4	2.3	5.4	7.3	4.7
To sober up after drinking alcohol <sup>***</sup>	0	1.6	1.0	5.1	2.8
<b>Other</b>					
Curious/try something new <sup>***</sup>	33.0	41.9	26.1	33.1	33.9
For the taste	26.2	26.3	29.6	29.4	28.2
My friends drink them <sup>***</sup>	23.4	28.0	6.8	12.1	16.7
To improve sports performance or physical activity <sup>*</sup>	9.4	14.9	9.1	9.4	10.6
Energy drinks are cool <sup>***</sup>	17.1	14.5	5.0	4.1	8.7
To help lose weight or help keep weight off	2.0	2.0	0.8	1.6	1.6
Other	2.0	0.1	1.5	1.0	1.0
None of the above <sup>***</sup>	27.1	15.2	16.1	8.5	14.3
Don't know/refuse to answer	0.8	1.2	0.6	1.6	1.2

\* p &lt; 0.05, significant difference by age group in chi square test.

\*\* p &lt; 0.01, significant difference by age group in chi square test.

\*\*\* p &lt; 0.001, significant difference by age group in chi square test.

<sup>a</sup> Numbers do not sum to 100, as respondents could select all options that applied.<sup>b</sup> The 74 respondents who selected “Somewhere else” responded outdoors (n = 30), with friends or at parties (n = 15), at a store/mall (n = 9), at events/concerts/etc. (n = 8), while on transit (n = 7), and a variety of other locations.



Recent (past-week) consumption was more prevalent among males, Aboriginal respondents, and residents of British Columbia. Previous Canadian studies have found greater prevalence of consumption among males (Azagba et al., 2014; Gupta et al., 2013; Pica et al., 2012; Reid et al., 2015), consistent with energy drink marketing that is geared towards males, featuring risk-taking behaviours (Miller, 2008b; Reissig et al., 2009). A recent analysis of data from Ontario high schools also found higher prevalence among off-reserve Aboriginal students (Reid et al., 2015). Between-province comparisons of energy drink consumption are difficult to make due to different methodologies and measures, but a national survey of grade 7, 9, 10, and 12 students found higher consumption of energy drinks mixed with alcohol in British Columbia (Azagba et al., 2013).

Overall, 16% of ever-consumers reported excessive consumption of CEDs (i.e., having consumed more than the usually-recommended limit of two energy drinks in a day), potentially increasing the risk of experiencing negative side effects. This proportion is somewhat lower than European findings indicating that 24% of adolescent and 19% of adult energy drink consumers reported drinking more than two cans on a single occasion (Zucconi et al., 2013). Among the youngest age group (12–14 years), excessive consumption was less prevalent, at just over 7% of ever-consumers. As with recent consumption, the behaviour of consuming more than two CEDs in a day was more common among Aboriginal respondents and ever-consumers in British Columbia, and also among older youth and young adults. Exceeding two CEDs in a day may have been more prevalent among young adults in part because of greater consumption with alcohol among this age group, although we are unable to discern this from the questions asked; however, some respondents' comments (data not shown) suggested that consuming multiple “bomb” shots (i.e., alcohol dropped into an energy drink) was not uncommon. A previous small study of US college students found that while consuming one energy drink in most situations was usual, consuming three or more was common if drinking with alcohol (e.g., while partying) (Malinauskas et al., 2007).

To our knowledge, the current study is one of the few to extend beyond simple measures of ever consumption or current frequency of consumption, to include history and context of energy drink consumption, such as locations and reasons for use. The most common reasons cited for consuming energy drinks were curiosity (33.9%), taste (28.2%), and “to stay awake” (especially for studying or work (31.9%), or for driving (27.1%)). Similarly, the top reasons among European adolescent consumers were taste (40%), need for energy (21%) and to stay awake (17%) (Zucconi et al., 2013). Social influences or situations may also be important reasons for use, and differ by age. Some consumers, particularly in the youngest age groups, cited “my friends drink them” (16.7%) or “energy drinks are cool” (8.7%), and a considerable proportion, particularly older youth, cited “going out or partying” (16.6%) or “to mix with alcohol” (21.1%) as reasons for use. Energy drinks were most often consumed at home (49.3%) or school (47.9%), at work (among young adults: 42.7%), or at another person's house (40.2%). This is consistent with European findings that the most common situations of CED consumption were “at home with friends during parties” and “at home in ordinary situations” (Zucconi et al., 2013).

## 5. Strengths and limitations

Existing Canadian studies on energy drink consumption among youth have relied on school-based samples, often within one province/region (Azagba et al., 2014; Paglia-Boak et al., 2013; Gupta et al., 2013; Reid et al., 2015). This study extends the age group to include young adults (up to age 24) and uses a national, web-based sample. Web panels may encounter issues of representation due to self-selection bias (as members opt in), under-coverage of some populations (although less an issue for young people), and panel attrition. While this sample was not a probability-based, representative sample of the general population, there was good geographic representation across Canada

among panel participants, and the sample was weighted to match national estimates for demographic groups (based on age, sex and region). This survey also extended to more detailed questions than most existing studies, which have typically included only one or two questions measuring ‘ever consumption’ of CEDs or current frequency of consumption. The study was cross-sectional, so causal inferences cannot be made from associations. Repeated administration of this cross-sectional survey will allow monitoring of trends in CED consumption and potentially identify associations over time.

## 6. Conclusions

While the majority of youth and young adults had consumed energy drinks, many were experimental consumers. A significant proportion of young adults had exceeded the guidance for daily maximum consumption, which may increase the likelihood of experiencing adverse effects. These findings provide insight on consumption of energy drinks among young people, and may help inform final regulations for these products. Clear and well-grounded regulations for energy drinks will be important for attenuating the potential adverse health effects associated with excessive or inappropriate consumption of CEDs.

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## Conflict of interest

The authors declare that there are no conflicts of interest. The sponsors of this research had no involvement in the study design, the collection, analysis and interpretation of data, the writing of the report, or the decision to submit the article for publication.

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